

THE RTA GUIDE TO SLOPE RISK ANALYSIS VERSION 3.1

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ABSTRACT

The RTA Guide to Slope Risk Analysis presents a procedure for analysing geotechnical risks associated with slopes adjacent to main roads in NSW. The procedure analyses the risk associated with actual or potential failure mechanisms which have been identified for a slope, using a series of defined ratings, which are combined through a risk matrix to generate an Assessed Risk Level (ARL) for the slope. The ratings are correlated to conditional probabilities for the likelihood and consequences of failure. Risk to life and economic risk are both analysed. Some of the methods used to allocate the ratings are presented. The inherent limits to the precision of risk analysis procedures are also discussed.

1 INTRODUCTION

The paper describes the *RTA Guide to Slope Risk Analysis Version 3.1*. The procedure has been developed for the purpose of analysing geotechnical risks associated with slopes, including retaining structures, adjacent to main roads in NSW. It is intended to be used in setting priorities for further work, which may take the form of investigation, monitoring, remediation or other measures as considered appropriate. The mandatory part of the procedure, together with an example of its use, is presented in *Appendix A*.

2 BACKGROUND

The development of a systematic slope risk analysis procedure by the RTA first started in the early 1990's. The early procedures (*Guide to a Slope Risk Rating System, Versions 1 and 2*), completed in 1994/5 were based on weighted scoring of slope attributes and a subjective assessment of consequences, combined using a risk matrix based on hazard and consequences, of the type subsequently used in AS4360 (1999). Data collection was intended to be undertaken by maintenance personnel, followed by desk analysis by a geotechnical practitioner. Proposed actions based on the resulting risk levels were directed towards setting priorities for inspection by a geotechnical practitioner, but were poorly defined. The procedure was used in a very limited way prior to late 1997. In late 1997 and early 1998 Version 2 was used statewide to assess about 2500 slopes. Review of the results of this programme indicated that the reproducibility of the analyses was poor and that the risk levels derived were not sufficiently accurate to set priorities for slope remediation and maintenance programmes.

Development of a new procedure commenced in mid 1999. Prior to its adoption, it was reviewed by independent experts (Dr Fred Baynes (FJB) and Professor Ian Lee (IKL)). The first edition of the new procedure (Versions 3.0/3.01 of the *RTA Guide to Slope Risk Assessment*) was used in late 2000 for analysis of about 600 slopes (later increased to over 700). This work was undertaken by a panel of consultants (seven external to the RTA, one internal) and involved about 25 practitioners. Initially the reproducibility of results (for sites analysed by the independent experts) was unsatisfactory. This necessitated substantial revision to definitions and allocation methods, followed by re-assessment of the results. The effects of the changes are discussed by Baynes et al (2002). Incorporation of these changes into the base document (and some further changes resulting from additional development work), followed by substantial rearrangement of the document, gave rise to Version 3.1 of the *RTA Guide to Slope Risk Analysis*.

3 PRINCIPLES OF OPERATION

The main function of the procedure is to facilitate the setting of priorities for further work. There are a number of essential requirements for a procedure of this type:

- It must be applicable to a large number of sites, covering a great range of conditions and be capable of being used by many practitioners, while still producing consistent results. Earlier versions were mainly oriented towards assessing cuttings. Very few embankments or natural slopes and no retaining structures were assessed. The new method had to be suitable for all of these types of slope.

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Guide to slope risk analysis, version 3.1, 2001 *Landslide Risk Management* Oldrich Hungr, Robin Fell, Réjean Couture, Erik Eberhardt, 2005-06-30 Landslide Risk Management comprises the proceedings of the International Conference on Landslide Risk Management held in Vancouver Canada from May 31 to June 3 2005 The first part of the book contains state of the art and invited lectures prepared by teams of authors selected for their experience in specific topics assigned to them by the JTC

Advances in Geomechanics and Geotechnical Engineering Hadi Khabbaz, Cholachat Rujikiatkamjorn, Mehdi Tamadon, Ali Parsa-Pajouh, 2025-10-10 This book presents the selected papers from the 28th Annual Symposium organised by the Sydney Chapter of the Australian Geomechanics Society AGS The symposium brought together key stakeholders from the Australian geological and geotechnical community The book showcases state of the art practices design approaches recent research findings and case histories covering a wide range of topics including emerging technologies in ground improvement advanced numerical models for soil consolidation applications of machine learning rock modelling slope stability risk management and innovative and sustainable considerations in design and construction It also highlights the application of recent in situ testing equipment and methodologies Furthermore the book discusses recent innovations trends concerns practical challenges encountered and solutions adopted within the field It serves as a valuable reference for academics and industry professionals engaged in geotechnical engineering This publication represents the collaborative efforts of numerous authors and qualified reviewers

IAEG/AEG Annual Meeting Proceedings, San Francisco, California, 2018 - Volume 2 Abdul Shakoor, Kerry Cato, 2018-08-25 This book is one out six IAEG XIII Congress and AEG 61st Annual Meeting proceeding volumes and deals with topics related to the geotechnical and environmental site characterization The theme of the IAEG AEG Meeting held in San Francisco from September 17 21 2018 is Engineering Geology for a Sustainable World The meeting proceedings analyze the dynamic role of engineering geology in our changing world The meeting topics and subject areas of the six volumes are Slope Stability Case Histories Landslide Mapping Emerging Technologies Geotechnical and Environmental Site Characterization Mining Aggregates Karst Dams Tunnels Groundwater Resources Climate Change Geologic Hazards Earthquakes Land Subsidence Coastal Hazards and Emergency Response and Advances in Engineering Geology Education Soil and Rock Properties Modeling

Landslides and Engineered Slopes. Experience, Theory and Practice Stefano Aversa, Leonardo Cascini, Luciano Picarelli, Claudio Scavia, 2018-04-17 Landslides and Engineered Slopes Experience Theory and Practice contains the invited lectures and all papers presented at the 12th International Symposium on Landslides Naples Italy 12 19 June 2016 The book aims to emphasize the relationship between landslides and other natural hazards Hence three of the main sessions focus on Volcanic induced landslides Earthquake induced landslides and Weather induced landslides respectively while the fourth main session deals with Human induced landslides Some papers presented in a special session devoted to Subareal and submarine

landslide processes and hazard and in a Young Session complete the books Landslides and Engineered Slopes Experience Theory and Practice underlines the importance of the classic approach of modern science which moves from experience to theory as the basic instrument to study landslides Experience is the key to understand the natural phenomena focusing on all the factors that play a major role Theory is the instrument to manage the data provided by experience following a mathematical approach this allows not only to clarify the nature and the deep causes of phenomena but mostly to predict future and if required manage similar events Practical benefits from the results of theory to protect people and man made works Landslides and Engineered Slopes Experience Theory and Practice is useful to scientists and practitioners working in the areas of rock and soil mechanics geotechnical engineering engineering geology and geology **Proceedings of the 5th International Conference on Transportation Geotechnics (ICTG) 2024, Volume 2** Cholachat Rujikiatkamjorn, Jianfeng Xue, Buddhima Indraratna, 2024-10-23 This book presents select proceedings of the 5th International Conference on Transportation Geotechnics ICTG 2024 It includes papers on ground improvement methodologies dynamics of transportation infrastructure and geotechnical intricacies of mega projects It covers topics such as underground transportation systems and heights of airfields and pavements This book discusses diverse thematic landscapes offering profound explorations into sensor technologies data analytics and machine learning applications The publication highlights advanced practices latest developments and efforts to foster collaboration innovation and sustainable solutions for transportation infrastructure worldwide The book can be a valuable reference for researchers and professionals interested in transportation geotechnics

Infraestructura y sostenibilidad en transporte Marcela Morales, 2011-01-01 Entendiendo que el desarrollo de la infraestructura y la sostenibilidad ambiental son ejes fundamentales para el desarrollo de los países y frente al reto de lograr satisfacer las necesidades de las generaciones presentes sin comprometer las posibilidades de las del futuro en una época donde el espacio para el desarrollo de nuevas infraestructuras es cada vez más restringido y donde se hace necesario innovar en procesos constructivos que garanticen la satisfacción y el desarrollo económico ambiental y social la Universidad de Medellín bajo la coordinación del Programa de la Maestría en Ingeniería Urbana y la Secretaría de Infraestructura Física de la Gobernación de Antioquia presentan el libro INFRAESTRUCTURA Y SOSTENIBILIDAD en el cual expertos nacionales e internacionales proponen avances para la gestión desarrollo y construcción de la infraestructura de transporte

Proceedings of the International Conference on Sustainable Environment, Agriculture and Tourism (ICOSEAT 2022) Arifin Dwi Saputro, Lilik Sutiarto, Rudiati Evi Masithoh, Jik Chang Leong, Katharina Keiblinger, Chaleeda Borompichaichartkul, Omer Said Toker, Rosnah Shamsudin, 2024-03-09 This is an open access book ICOSEAT 2022 was held on July 21-23 2022 in Bangka Island one of the wonderful places of Indonesia Articles in the field of Agroindustry and Appropriate Technology 4.0 Environmental and Mining Engineering Sustainable Development and Tourism Management Agriculture and Food Engineering and Marine Aquaculture and Biological Science ICOSEAT provides a forum for Academic

Business and Government to present and discuss topics on recent development in those fields *Soil Health and Environmental Sustainability* Pravat Kumar Shit, Partha Pratim Adhikary, Gouri Sankar Bhunia, Debashish

Sengupta, 2022-09-27 This book demonstrates the measurement monitoring mapping and modelling of soil pollution and land resources This book explores state of the art techniques based on open sources software radioactive wastes microbiology of soil and sediments soil salinity and sodicity pollution from landfill sites soil erosion and contamination from agricultural activities heavy metal pollution and health risk environmental impact and risk assessment sustainable land use landscape management and governance soil degradation and risk assessment agricultural soil pollution pollution due to urban activities soil pollution by industrial effluents and solid wastes pollution control and mitigation in extreme environments The content of this book is of interest to researchers professionals and policy makers whose work is in soil science and agriculture practices The book equips with the knowledge and skills to tackle a wide range of issues manifested in geographic data including those with scientific societal and environmental implications *Monthly Catalog of United States Government Publications*, 1983

Monthly Catalog of United States Government Publications United States. Superintendent of Documents, 1983 February issue includes Appendix entitled Directory of United States Government periodicals and subscription publications September issue includes List of depository libraries June and December issues include semiannual index *Monthly Catalogue, United States Public Documents*, 1983 **South African Journal of Science**, 2007 **Landslide Risk**

Assessment E. Mark Lee, 2023 Landslide Risk Assessment Third edition is the essential guide on establishing the likelihood and extent to which future slope failures could adversely impact society and affect urban areas This book examines a variety of approaches to landslide risk assessment and management It introduces the key challenges that practitioners will need to overcome when estimating the probability and consequences of landsliding The use of risk criteria is described marking the important transition between risk assessment and risk management Now updated with the latest ISO and Society for Risk Analysis guidance and with a focus on the impact of uncertainty and strength of knowledge on assessing risk plus much more this book is the authoritative must have purchase for any practitioner operating in this area With international case studies and examples to allow you to put theory into practice this book covers risk concepts and models basic elements of landslide risk assessment landslide hazard qualitative and quantitative risk assessments exposure and vulnerability consequences quantifying risk assessing uncertainty and strength of knowledge This title will appeal to any geotechnical or civil engineer involved in slope engineering and landslide risk It will have additional appeal to risk analysts geomorphologists hydrologists foresters environmental consultants students academics and researchers Publisher's website **Design Risk Analysis**

Timothy R. Neuman, Charles V. Zegeer, 1991 *Rock Slope Risk Assessment* P. McMillan, 1995 **Slope Engineering for Mountain Roads** Gareth J. Hearn, 2011 Provides a complete guide to the study design construction and management of landslide and slope engineering measures for mountain roads with emphasis on low cost The geographical focus is on the

tropics and sub tropics but is also highly relevant to other regions where heavy rain steep slopes and weak soils and rocks combine to create slope instability The causes and mechanisms of landslides are described and the hazards they pose to mountain roads are illustrated Methods of desk study field mapping and ground investigation are reviewed and illustrated with emphasis on geomorphological and engineering geological techniques The design and construction of alignments earthworks drainage retaining structures the stabilization of soil slopes and rock slopes and the control of erosion on slopes and in streams covered Slope management as part of road maintenance and operation is reviewed and procedures for risk assessment and works prioritization are described *Slope Stability Spatial Analysis and Risk Assessment* Nurdina Marianna Che Mohamed Rani,2000 *Landslide Risk Assessment* E. Mark Lee,David K. C. Jones,2014 *Guide to Risk Assessment and Allocation for Highway Construction Management* Keith R. Molenaar,David B. Ashley,2006

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